Jan. 14, 1930. R. L. SHRINER 1,743,573

ELECTRICALLY OPERATED WATER HEATER

Filed April 14, 1927

Fig. 1

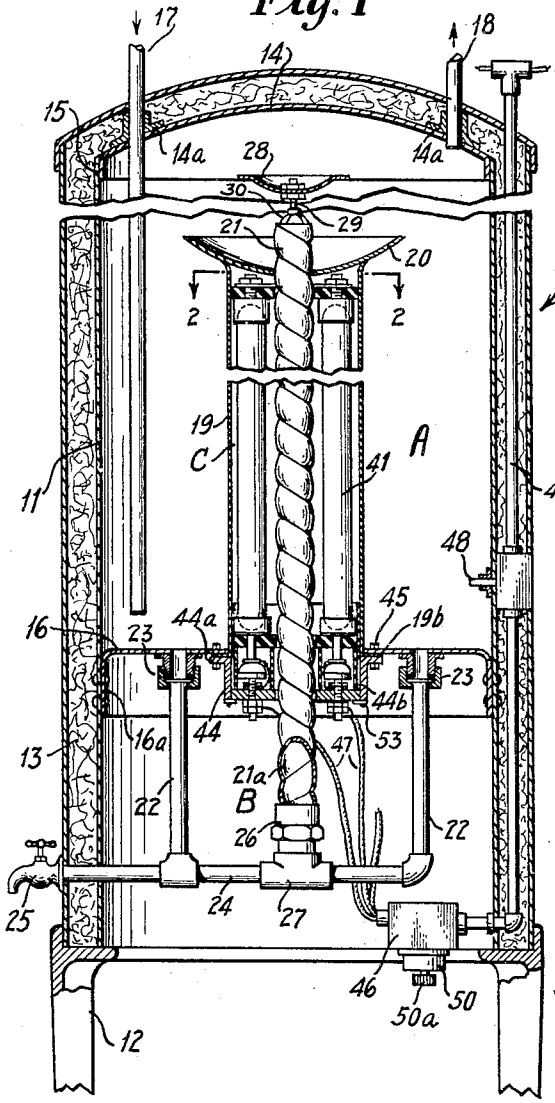


Fig. 2

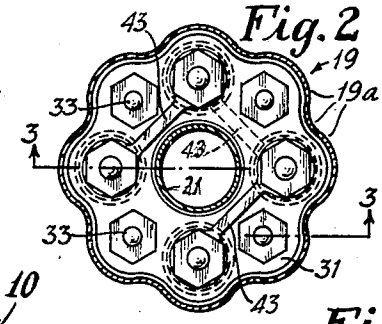
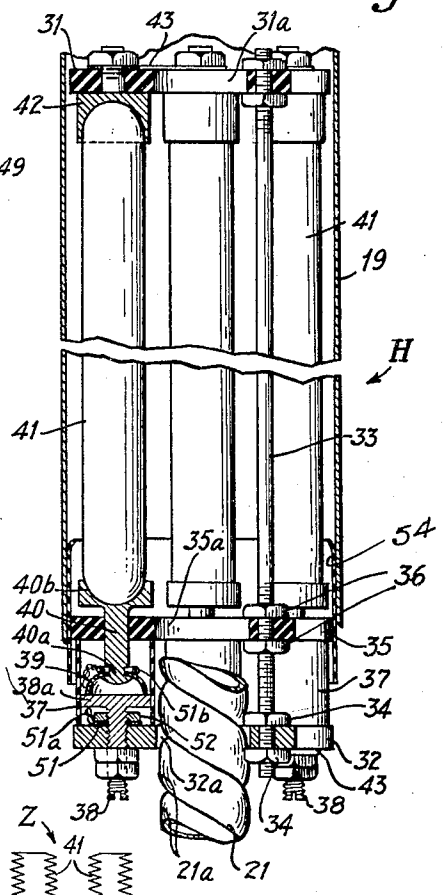


Fig. 3



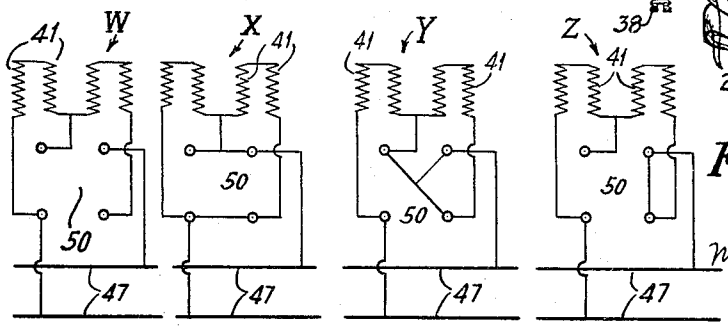


Fig. 4

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ELECTRICALLY-OPERATED WATER HEATER

Application filed April 14, 1927. Serial No. 183,709.

This invention relates to heating devices and more particularly is directed to an electric heating system and unit for water heaters.

One object of the invention is to provide an improved electrically operated system for water heaters in which there is an efficient circulation of water.

A further object of the invention is to provide an improved heating system for water heaters in which there is efficient heat transference at a minimum of heat losses.

Another object of the invention is to provide an electrically operative heating system and apparatus of the character described comprising few and simple parts, which shall be relatively cheap to manufacture, and which may be readily disassembled for inspection and replacement and repair of defective parts.

Still another object of the invention is to generally improve water heaters of the character described to render same practical, efficient and economical in operation to a high degree.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

Certain features herein shown and described are shown, described and claimed in my co-pending application Serial No. 159,251 filed Jan. 6, 1927, and accordingly are not claimed herein.

With the above exception, the invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the following claims.

In the accompanying drawing, in which is shown one of the various possible illustrative embodiments of this invention,

Fig. 1 is a cross-sectional view of an electrically operated water heater embodying the invention.

Figs. 2 and 3 are cross-sectional views taken on lines 2—2 and 3—3 in Figs. 1 and 2, respectively.

Fig. 4 is a diagrammatic view showing various switch connections of the heater element to the electric supply source.

Referring in detail to the drawing, 10 denotes an electrically operated water heater constructed to embody the invention. Said heater is seen to comprise a casing 11 mounted upon a standard 12 and provided with a suitable heat insulating covering 13 formed of magnesia, asbestos, felt or the like material applied thereover in any suitable well known manner. The upper end of the casing 11 is provided with a top closure or head 14 which is connected to the casing by a lap joint 15 being either riveted or welded or otherwise suitably secured to make a water-tight joint. A circular base plate 16 is mounted at a substantial distance from the bottom of the casing 11 for partitioning the water receiver or reservoir A above the plate 16 from the lower compartment B below the same. Said plate 16 has a peripheral outturned edge portion 16^a which lies in close contact with the casing 11 and may be riveted or welded thereto to provide a water-tight joint. 17 indicates an inlet pipe which admits cold water to the receiver A from a suitable water supply source (not shown), and 18 indicates an outlet pipe through which the hot water is drawn to the receiver. The pipes 17 and 18 are connected to the head 14 by means of the flange fittings 14^a which are joined to the head by suitable means such as welding, rivets, bolts or the like.

Mounted on the plate 16 to extend axially with respect to the casing 11 is a tubular housing 19 provided with corrugations 19^a extending substantially the length thereof. Said casing forms a chamber C and is secured water-tight to the plate 16 by an outwardly turned flange 19^b. The upper end of the housing is closed by means of a dished plate 20 which is centrally perforated for receiving a vertically extending pipe 21 which extends axially through the housing 19. Pipes 22 spaced in parallel alignment with pipe 21 are provided for communicating with the reservoir A through the plate 16. Each pipe 22 detachably connects at one end with plate 16 by means of a union coupling 23, and the other end of each of said pipes

22 connects with a horizontally extending pipe 24 which terminates in a faucet 25 for draining the reservoir A. The pipe 21 is joined at its lower end through a coupling 26 with the pipe 24 by a T-fitting 27, the upper end of the pipe 21 being open and in communication with the reservoir A. The pipe 21 is preferably formed of tubing and may be made with a helical ridge 21[a] in its wall structure as shown in Figs. 1 and 2. Mounted to extend above the end of the pipe 21 is a baffle plate 28 which is carried by a rod 29 suitably secured to the upper end of the pipe 21 by a crow-foot or hicky 30 in the well-known manner.

Referring now to Figs. 2 and 3, the electric heater unit H is seen to comprise an upper head plate 31 and a lower plate 32 both of which may be shaped to correspond to the cross-section of the housing 19 and are held in fixed relation with respect to each other by stay-bars 33 and nuts 34. An intermediate insulating plate 35 is mounted in spaced relation to the plate 32 and is held in position by said stay-bars 33 and nuts 36. Mounted between the plates 32 and 35 at equal intervals, preferably in concentric relation, are four insulating tubes 37. Passing through the plate 32 and electrically insulated to extend into the tube are the screw members 38, each of which has a head 38[a]. The latter is adapted to be adjusted longitudinally of the tubes 37 by rotating said member 38. A dished spring 39 rests on each of the heads 38[a] and is firmly secured to the lower ends 40[a] of plunger 40 which is adapted to slide through the insulating plate 35. The upper end of each plunger is formed with a cup-shaped portion 40[b] and is adapted to support the lower ends of the resistance elements 41. Mounted on the upper plate 31 opposite each of the cup portions 40[b] and in alignment therewith are the cup members 42. Each of the latter is adapted to receive the upper ends of one of the resistance elements 41. In the embodiment of the invention here shown four heater elements are employed which are adapted to be connected in series and in series parallel relation, the upper ends of the resistance elements being interconnected by means of connectors 43. The electrical heater unit H is thus seen to form a unit as shown in Fig. 3 which is positioned interiorly of the housing 19 and is removably held in place by a supporting head 44. The latter is provided with a flange 44[a] which is detachably secured against the housing flange 19[b] and the plate 16 by the bolts 45, and is formed with a passage 44[b] through which the electric heater unit extends into the chamber C, as shown in Fig. 1.

The plates 31, 32 and 35 of the heater unit are provided with centrally aligned openings 31[a], 32[a] and 35[a], respectively, which form an axial passage for receiving the pipe 21 so that the resistance elements are disposed in close relation between the pipe 21 and the housing 19 as shown in Figs. 1 and 3. Mounted in the lower compartment B under the reservoir A is the switch or junction box 46 through which pass conductor leads 47 for connecting the resistance elements of the heater with the electric power supply source (not shown).

48 indicates a conventional type of thermostat which may be installed to extend through the casing 11 into the reservoir A and is designed to regulate the operation of the heater in accordance with the temperature of the water. The thermostat used in the installation described above forms no part of the invention and any of the thermostats well known in the art may be used. A conduit 49 mounted to extend through the covering 13 serves to carry the conductor wires 47 which connect the heating system to the source of power.

A switch 50 is mounted on the box 46 and controls the power supply to the heater unit. Said switch may be of any standard construction and is adapted to selectively connect in circuit the pairs of resistance elements either in series or series-parallel as is clearly shown diagrammatically in Fig. 5. Thus in the position of the switch shown at W, the circuit is open. In the position X, the resistance elements are connected in series-parallel. In position Y, only one pair of resistance elements are connected in circuit, the other two being shunted out of circuit, and in the position shown at Z, the elements are all connected in series. As shown in Fig. 1, the switch 50 may be of the rotary type and controls the circuit by rotation of a key 50[a] for consecutively positioning the switch connections to join the pairs of resistance elements as shown at X, Y and Z in Fig. 4 in the well understood manner.

The operation of the apparatus will now be clear. The cold water enters through the pipe 17 and fills the reservoir A. Water also fills pipes 21, 22 and 24. When the temperature of the water in the reservoir A falls to a certain predetermined point, the thermostat starts the operation of the heating unit on closing the electric circuit through manipulation of the switch key 50[a]. Current then flows through the leads 47, the screw members 38, the heads 38[a], the springs 39, the plungers 40, the cup-shaped portions 40[b], and the resistance elements 41. If desired, a flexible jumper 51 may be secured to form a shunt circuit between each head 38[a] and its contacting plunger 40 so that practically all the current passes through the jumpers 51 rather than through the springs 39. Each jumper 51 may have insulating beads 51[a] strung thereon and has one end anchored to the plunger 40 by means of a washer 51[b] secured over the spring 39, the other end of the jumper

being locked under a nut 52 threaded on the screw member 38, as is clearly shown in Fig. 3.

By means of connectors 43, a series path for the current is provided through the pairs of resistance element 41. Thus the current flows through said leads 47 and resistance elements sucessively. With said elements connected to the power circuit, they are heated to a medium temperature when the switch is in the position shown at Z in Fig. 5, and to a higher temperature when the switch is in the position corresponding to X and Y in Fig. 5. The heat developed by these elements is transmitted to the pipe 21 by both radiation and conduction. While the heat is transferred at maximum intensity to said pipe, it is also transferred to the housing 19 and heats the water in the reservoir A. It should be noted that the heater elements are brought in very close proximity to the walls of the pipe 21 and housing 19 so that the heat is received and transmitted through said walls with a minimum of heat losses.

The circulation of the water results from the well known physical fact that the density of the water is greater at lower than at higher temperature. The circulation of the water takes place in the following course:

The cold water sinks in the pipes 22 and 24 and passes through the T-fitting 27 into the pipe 21 where the temperature of the water is raised by the heat received from the unit H. This, of course, causes the hot water to rise and consequently the cooler water falls behind, where it is in turn raised in temperature until it passes out of the upper end of the pipe 21 into the reservoir A. In order to facilitate rendering more efficient the heat transfer between the water and the hot surface of the housing 19, the latter as has been described above is corrugated longitudinally so as to present a large heat radiating surface, and the dished plate 20 of the housing 19 is extended beyond the corrugated wall of the housing to break up the water stream and to give it a stirring action in the reservoir A.

When the water in the reservoir has reached the upper limit of the temperatures for which the thermostat is set, the latter operates to open the main circuit thus shutting off the current supply. The action of the heater is thereby rendered entirely automatic and hot water of any desired temperature within the usual heater range may be withdrawn through the pipe 18. The switch 50 when set as shown at W in Fig. 4 renders the heating system entirely inoperative, and the switch settings shown at X, Y and Z permit the control of the heating to take place at a slower or more rapid rate, as desired, as will be readily understood.

In order to simplify the assembly of the apparatus and also the replacement of the parts such as the resistance elements, the chamber B is made of sufficient size to permit the vitals of the heater unit to be dropped sufficiently to give ready access to its parts. Thus, when it is desired to inspect or replace a resistance element the water need not be drained from the receiver A nor the water pipe disconnected, it being merely necessary to dismount the heater unit from the supporting head 44 by swinging the holding latches 53 to release the heater unit and to drop it down in the well understood manner. The parts of the unit may then be inspected or replaced. Inasmuch as the elements 41 are held between the cup shaped portions 40^b and the cup members 42 by means of the springs 39 the operation of replacing one of these elements is extremely simple, it merely being necessary to lower the screw member 38 to permit removing the element from the plunger cup portions 40^b.

When first installing the device or when putting it in service after it has not been used for some time, filling of the reservoir A with cold water may cause the interior wall of the housing 19 to condense moisture from the surrounding air due to the well known phenomenon commonly known as "sweating". Such moisture will accumulate in drops, run down the side wall of the housing 19 and lodge between the current carrying parts of the heating unit H and the housing, as for example between the outside of the cup members and the adjacent wall portion of the housing 19, thus grounding the circuit to the housing 19 through said accumulated moisture. On evaporation of said moisture, arcing will result which will perforate the housing and cause it to leak. To overcome this possible serious objection, a layer of suitable absorbing material 54, such as sheet asbestos is inserted about the periphery of the plate 35, said layer being extended up along the side of the housing beyond the cup portions 40 so that any accumulation of moisture that runs down the side of the housing is caught and absorbed by said material 54. The latter is dried on operating the heater unit H without the least injury or damage to the device.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. In a water heater of the class described, an electrical heating unit comprising a plurality of spaced resistance elements connected

in electric circuit, and spring means for demountably securing said individual elements in said circuit, said means including a socket member for receiving one end of each of said elements, resilient means secured to said socket member, and means for adjusting the tension of said resilient means.

2. In a water heater of the class described, an electrical heating unit comprising a plurality of spaced resistance elements connected in electric circuit, and means for demountably securing said individual elements in said circuit, said means including a socket member for receiving one end of each of said elements, resilient means secured to said socket member, and means for adjusting the tension of said resilient means, said adjusting means comprising a member having a head portion supporting said resilient means, and a screw threaded shank portion extending therefrom.

3. In a water heater of the class described, an electrical heating unit comprising a plurality of spaced resistance elements connected in electric circuit, and means for demountably securing said individual elements in said circuit, said means including a socket member for receiving one end of each of said elements, resilient means secured to said socket member, and means for adjusting the tension of said resilient means, said adjusting means comprising a member having a head portion supporting said resilient means, and a screw threaded shank portion extending therefrom, and jumper means for connecting said shank portion and said socket member.

In testimony whereof I affix my signature.

ROBERT L. SHRINER.